

QUALITY OF AGRICULTURAL DRAINAGE DISCHARGING
TO THE SAN JOAQUIN RIVER AND DELTA FROM
THE WESTERN PORTION OF SAN JOAQUIN COUNTY, CALIFORNIA
APRIL 1986 TO MAY 1988

California Regional Water Quality Control Board
Central Valley Region
3443 Routier Road
Sacramento, CA 95827-3098

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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INTRODUCTION

The Agricultural Unit of the Central Valley Regional Water Quality Control Board (Regional Board) initiated a water quality monitoring program in April 1986 to evaluate the effects of subsurface agricultural drainage water discharges from Western San Joaquin County on the Western Delta Sloughs and the San Joaquin River water quality. The study area is agricultural land located on the western side of the San Joaquin River within western San Joaquin County. The purpose of this monitoring program was to compile a data base for selected inorganic constituents found in the agricultural drains that are discharging into the Delta and San Joaquin River. This data base will be used in the development and evaluation of the need for an agricultural drainage reduction program.

The majority of the subsurface agricultural drainage pollutant load is discharged to the San Joaquin River via Mud Slough (north) and Salt Slough in Merced County (James et al., 1988a and 1988b, Westcot et al., 1989a and Chilcott et al., 1989). The impact of these discharges, however, is highly modified by numerous surface discharges downstream of these two sloughs. The importance of these downstream discharges is manifested by the finding that the majority of the San Joaquin River from Salt Slough and Mud Slough (north) inflows downstream to Vernalis in many months of the year is made up entirely of agricultural return flows.

The San Joaquin River is thus highly modified by the time it reaches the Delta. The river is further modified in the Delta by localized extractions and discharges. The main influences on the San Joaquin River flow in the Delta are the U.S. Bureau of Reclamation and State Water Project extraction pumps located near Tracy. The majority of the river flow returns to these pumps. The quality of the San Joaquin River is also influenced by localized subsurface drainage water discharges upstream and downstream of the project extraction pumps. Little information is available on the quality and magnitude of these localized discharges.

The most significant discharges occur from the western side of the San Joaquin River in both San Joaquin County and Contra Costa County. A previous report detailed the characteristics of drainage water entering from the eastern portion of Contra Costa County (Westcot et al., 1989c). The objective of this study is to characterize the discharges known to enter the San Joaquin River from the western portion of San Joaquin County. The goal is to develop a data base that can be used in assessing beneficial use impairment and to determine whether there is a need for regulatory actions.

STUDY AREA

The study area consists of the western portion of San Joaquin County that drains into the San Joaquin River and Delta waterways (Figure 1). Drainage discharges occur throughout the southern uplands section of the South Delta Area (Department of Water Resources, 1987) and many of these discharges find their way to the lower section of the San Joaquin River which extends from approximately the Delta-Mendota Canal Intake near the Contra Costa County line south to Greenwood Road near the Stanislaus County line. Major portions of the irrigated land within this area have subsurface drainage systems.

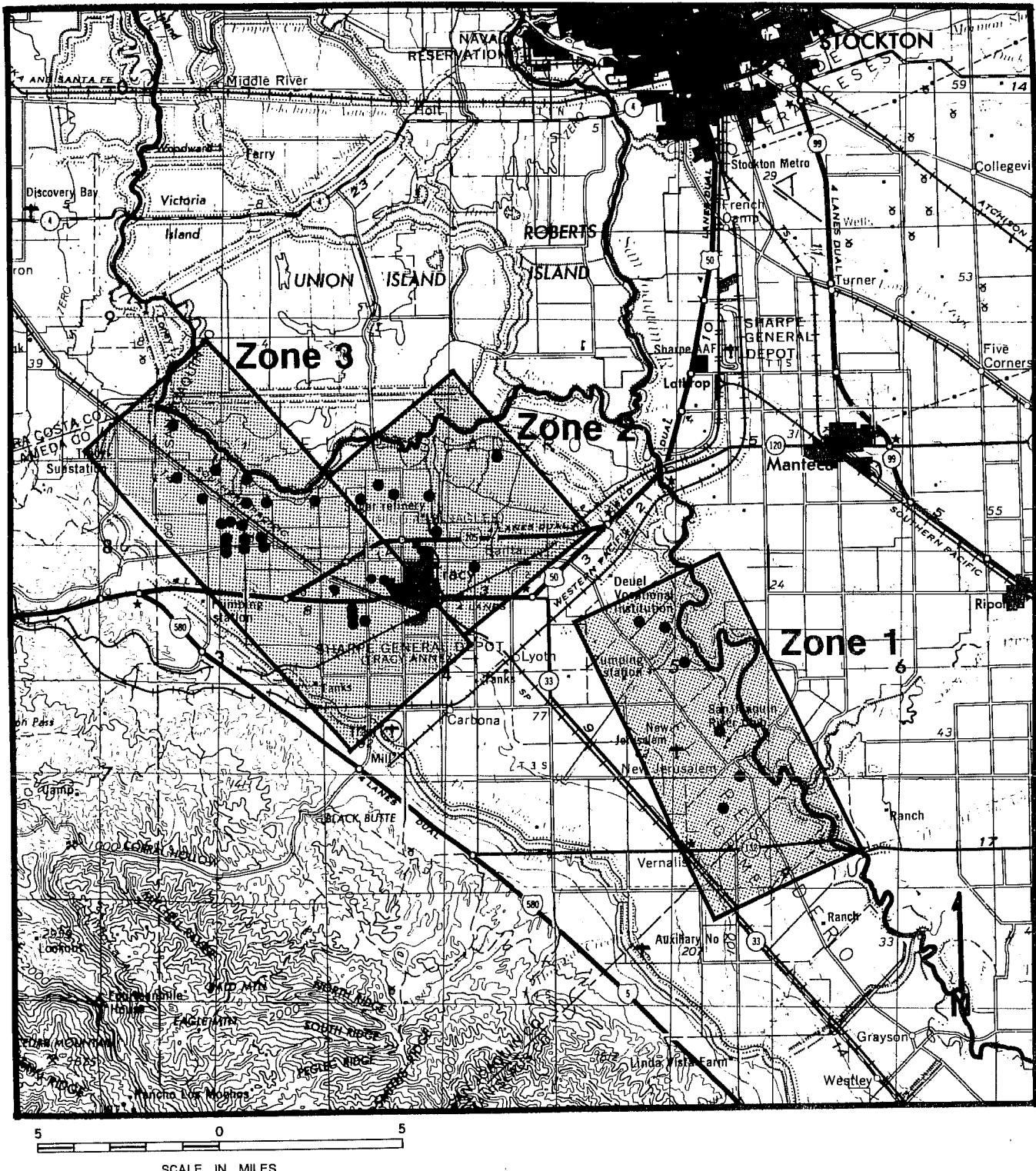


Figure 1. Zone Location Map of Drainage Monitoring Sites That Flow Into The San Joaquin River and Delta From Western San Joaquin County.

The study area was divided into three zones determined by localized water distribution and management influences. Zone 1 is influenced by the New Jerusalem Drainage District and discharges directly to the San Joaquin River upstream of the Mossdale Bridge at Interstate 5 Highway. Zone 2 is influenced by the Delta sloughs while Zone 3 is influenced by the west side Coast Range streams. Both Zones 2 and 3 discharge to Old River Channel in the Delta.

Monitoring sites and their locations are listed in Table 1 and shown on Figures 2 and 3. Water quality monitoring was conducted on all of these sites.

Table 1. Drainage flow monitoring sites in Western San Joaquin County

Zone 1. Southern Sites	Zone 3. Northwestern Sites
SJC001 New Jerusalem Tile Drain	SJC003 Grant Line Road Tile Drain Sump
* SJC028 Crichtett Road Drain	SJC004 Bethany/Lammers Tile Drain
SJC029 Wright Road Collector Drain	SJC005 Patterson Pass Road Tile Drain
* SJC030 Yasui Surface Drain	SJC006 Moitoso Tile Drain
SJC031 Yasui (Fisk) Ranch Tile Drain	SJC007 Krohn Road Drain
* SJC042 San Joaquin River Club	SJC008 Pimentel Tile Drain
Zone 2. Northeastern Sites	SJC010 Westside Irrigation District Main Drain
SJC002 Tracy Blvd. Tile Drain Sump	SJC013 Costa Brothers East Tile Drain
SJC009 Lammers/Corral Hollow Tile Drain Sump	SJC014 Costa Brothers West Tile Drain
SJC011 Delta Avenue Tile Drain	SJC015 Castro Tile Drain
SJC024 Corral Hollow/Bethany Tile Drain Sump	SJC016 Earp Tile Drain
SJC026 Chrisman Road Tile Drain	SJC017 Freeman Tile Drain
SJC043 Discharge to Sugar Cut	SJC018 Costa Tile Drain
SJC044 Larch Road Drain	SJC019 Moitoso and Castro Tile Drain
* SJC032 Kelso Road Drain	
SJC033 Mountain House Creek	
* SJC034 Westside Irrigation District Disch. Pump	
* SJC035 Naglee/Burk Pump # 6	
SJC036 Kelso Road/Byron Hwy Tile Drain Sump	
SJC037 Spirow Nicholaw Tile Drain	
SJC038 JM Laurence Jr. East Tile Drain	
SJC039 JM Laurence Jr. West Tile Drain	
SJC040 Sequeira Tile Drain	
SJC041 Reeve Road Tile Drain	

* Sites with tailwater drainage, not used in statistical calculations.

METHODS

The study was initiated in April 1986 and periodic sampling was conducted through the end of May 1988. The frequency of sample collection for this monitoring program varied but generally grab samples were collected monthly during the irrigation season. Additional samples were taken at selected times during the nonirrigation season. This sampling frequency was supplemented by sampling at selected sites by other agencies (Appendix A).

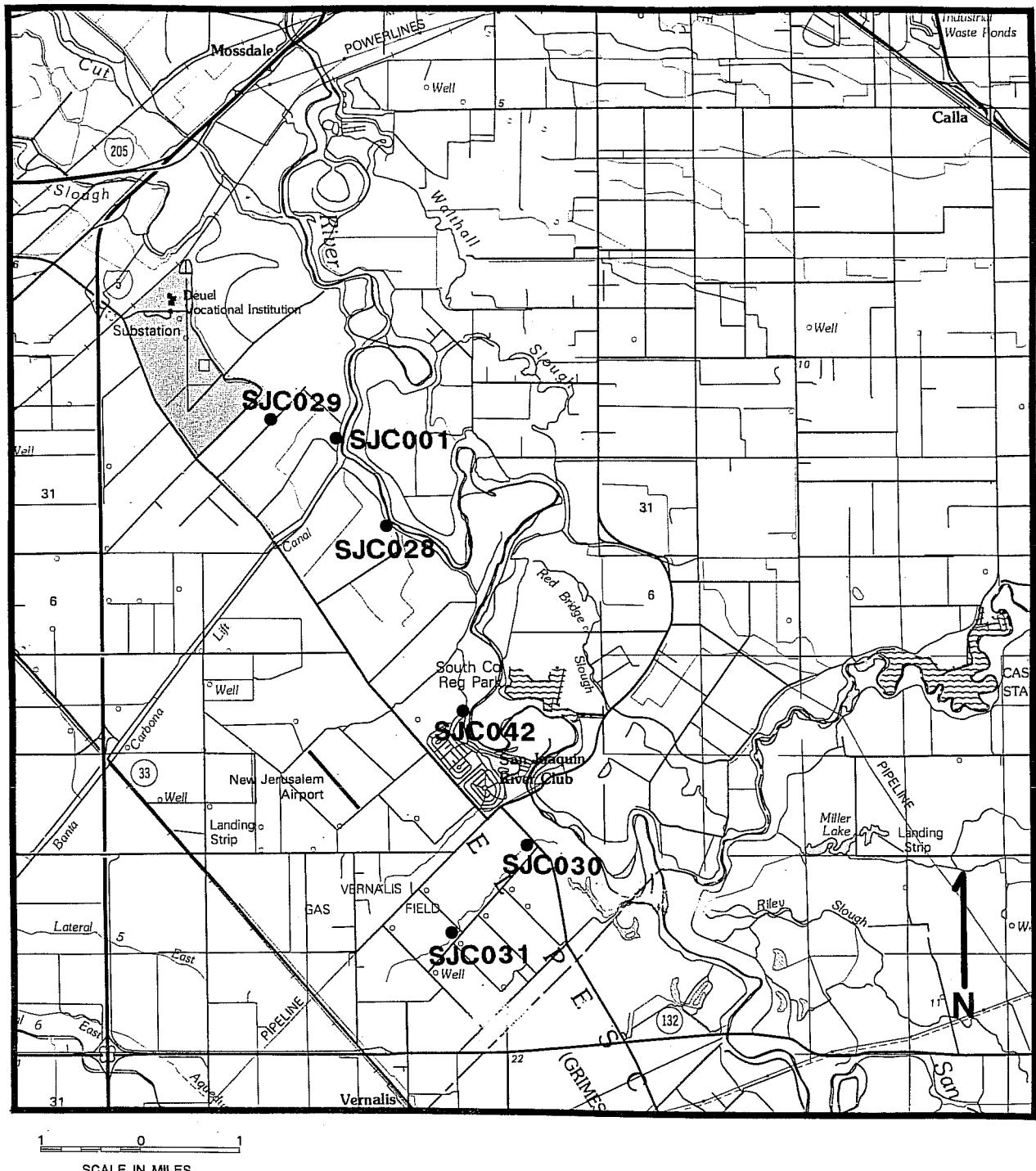


Figure 2. Location Map of Zone 1 Monitoring Sites.

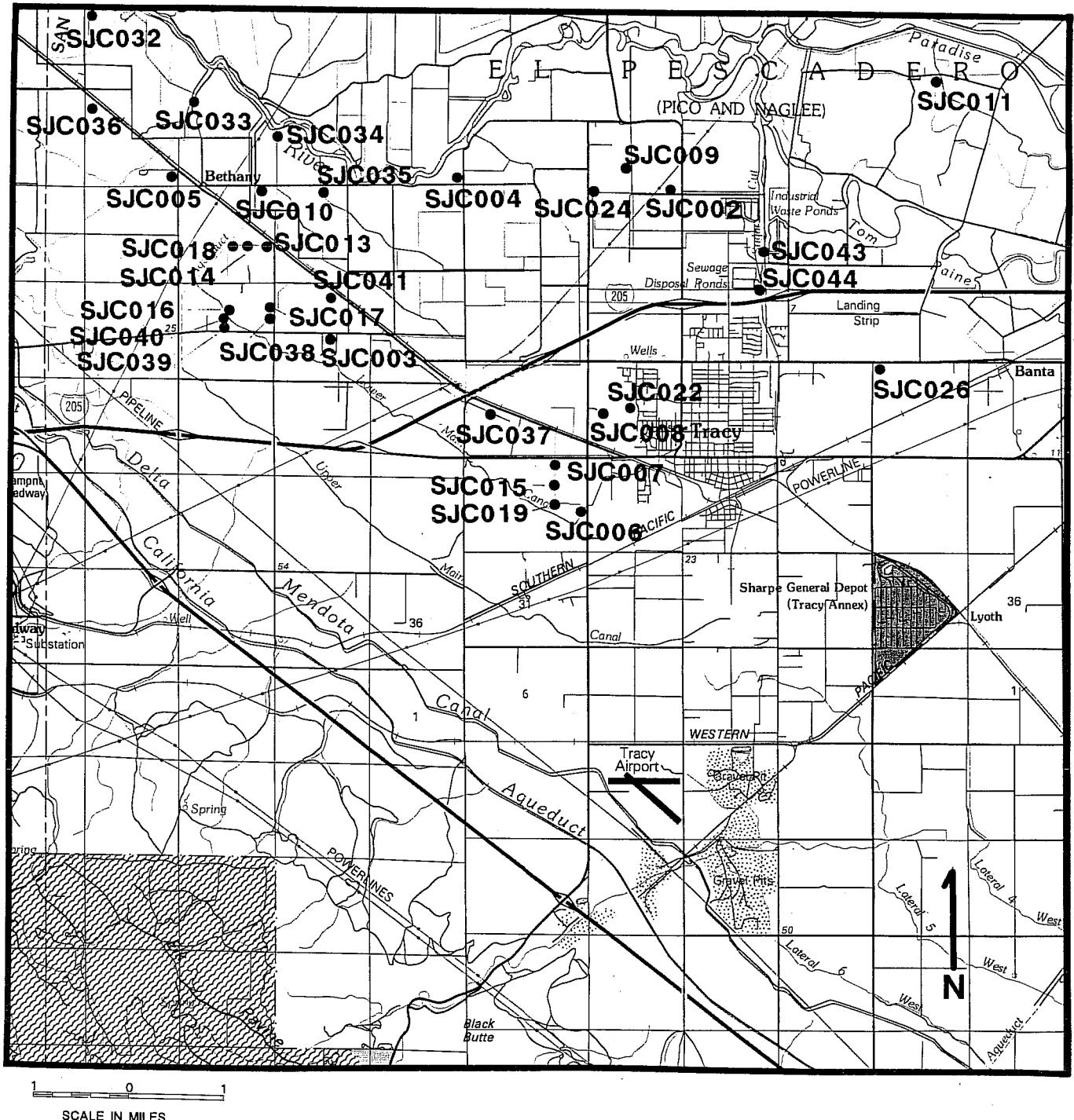


Figure 3. Location Map of Zones 2 and 3 Monitoring Sites.

All samples were analyzed for total recoverable selenium, boron, chloride, sulfate, total alkalinity and electrical conductivity (EC). Selected sites during 1986 were tested for total recoverable copper, chromium, lead, mercury, molybdenum, nickel, and zinc. Water temperature, pH, EC and sample time were recorded in the field at each site. All samples were collected in polyethylene bottles. All sample bottles were washed and acid rinsed in the laboratory prior to use and rinsed three times with water to be sampled prior to sample collection. Selenium and other trace element samples were preserved by lowering the pH to less than 2 using ultra-pure nitric acid fixation techniques. All samples were kept on ice until preservation or submittal to the laboratory for analysis.

A quality control and quality assurance program was conducted utilizing spike and duplicate samples in the laboratory. Blind replicate samples were collected at 10 percent of the sites and 50 percent of the blind replicates were spiked for laboratory quality assurance. All reported results fall within the quality assurance tolerance guidelines.

RESULTS

Concentrations of the measured constituents varied between discharge sites, time of year, and between years. Median values for selected constituents are listed in Table 2. Water quality for the individual sites and sampling dates are given in Table 3. The median salinity (EC) was 2,500 $\mu\text{mhos}/\text{cm}$ for Zone 1, 2,600 $\mu\text{mhos}/\text{cm}$ for Zone 2, and 2,300 $\mu\text{mhos}/\text{cm}$ for Zone 3. This compares with a median EC of 6,100 $\mu\text{mhos}/\text{cm}$ for drains coming from the Panoche Fan area (Chilcott et al., 1988). The median boron concentration was highest in Zone 3 (3.0 mg/L) and lowest in Zone 2 (1.5 mg/L). These compare with a median of 7.9 mg/l from subsurface drains in the Panoche Fan area (Chilcott et al., 1988). The overall median boron concentrations (2.5 mg/L) are approximately equal to those reported in the Contra Costa County area (2.8 mg/L) (Chilcott et al., 1988 and Westcot et al., 1989c) but are higher than drains in the western Stanislaus County area (1.5 mg/L) (Westcot et al., 1989). Boron has been known to cause crop toxicity problems in this area and even though subsurface drains have been in operation for over 20 years, boron concentrations continue to be high. The median chloride concentrations for Zones 1, 2, and 3 were 350 mg/L, 360 mg/L, and 390 mg/L respectively and with an overall median concentration of 380 mg/l for all zones. This compares to a median concentration of 2400 mg/l for drains coming from the Panoche Fan area (Chilcott et al., 1988) and 270 mg/L for the western Stanislaus County (Westcot et al., 1989). The median sulfate concentrations for Zones 1, 2, and 3 were 480 mg/L, 352 mg/L, 320 mg/L respectively and with an overall median concentration of 360 mg/L for all zones. This compares to the significantly higher median concentration of 2336 mg/L for drains coming from the Panoche Fan area (Chilcott et al., 1988) and is similar to the median value of 340 mg/L for the western Stanislaus County (Westcot et al., 1989).

Selenium concentrations from the monitored sites are low. Median selenium concentrations for Zones 1, 2, and 3 were 4.6, 1.6, and 2.1 $\mu\text{g}/\text{L}$ respectively and with an average median concentration of 2.3 $\mu\text{g}/\text{L}$ for the entire study area. Although total recoverable selenium varied from 0.4 to 13.5 $\mu\text{g}/\text{L}$, the

concentrations did not vary seasonally. The 4.6 µg/L found in Zone 1 compares well with the median concentration of 5 µg/L found by the U.S.Bureau of Reclamation for the New Jerusalem Tile Drain (SJC001) (U.S.B.R., 1987, U.S.B.R., 1989) This site represents drainage from approximately 11,000 acres of land in Zone 1. The median concentration for the Panoche Fan area was 120 µg/L and 2 µg/L for western Stanislaus County (Chilcott et al., 1988). Concentrations of other trace elements (Mo, Cr, Cu, Ni, Pb, and Zn) are also low and continue to follow the general pattern suggested by Chilcott et al., 1988. Seasonal variability was not notable.

Table 2. Summary of selected constituent ranges for drainage monitoring sites that flow into the San Joaquin River and Delta from Western San Joaquin County.

	EC umhos/cm	B mg/L	Cl mg/L	SO4 mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Total		
									Alkalinity mg/L	Hardness mg/L	TDS mg/L
Zone 1	Minimum	1730	1.2	190	200				96		
	Median	2500	2.8	350	480				280		
	Maximum	9400	15	1720	300				450		
	Data Count	15	19	19	17				13		
Zone 2	Minimum	1500	0.2	200	150	186	99	284	0.4	76	850 1800
	Median	2800	1.5	360	352	280	198	474	0.9	290	1500 2800
	Maximum	6850	5.1	1430	1250	445	282	561	2.0	520	240 4200
	Data Count	27	38	38	34	3	3	3	27	3	3
Zone 3	Minimum	410	0.4	43	31	28	16	89	1.0	72	120 440
	Median	2550	3.0	390	320	79	44	310	2.2	300	293 1275
	Maximum	4000	9.4	1100	110	129	68	351	9.0	510	590 1500
	Data Count	80	110	110	96	4	4	4	4	76	4 4
Total of all Zones	Minimum	410	0.2	43	31	28	16	89	0.4	72	120 440
	Median	2600	2.5	380	360	129	68	350	1.4	290	590 1500
	Maximum	9400	15	1720	3000	445	282	561	9.0	520	2400 4200
	Data Count	122	167	167	147	7	7	7	7	116	7 7

	Se ug/L	Mo ug/L	Cu ug/L	Cr ug/L	Ni ug/L	Pb ug/L	Zn ug/L	Hg ug/L
Zone 1	Minimum	2.0	<5	<1	<1	<5	<1	<0.5
	Median	4.6	17	1	5	<5	<1	<0.5
	Maximum	13.5	35	6	26	<5	1	<0.5
	Data Count	13	6	6	6	6	6	5
Zone 2	Minimum	0.4	<5	<1	<1	<5	<1	<0.5
	Median	1.6	6	<1	<1	<5	<1	<0.5
	Maximum	3.5	82	61	14	15	74	1
	Data Count	17	18	18	18	18	18	22
Zone 3	Minimum	0.5	<5	<1	<1	<1	<1	<0.5
	Median	2.1	<5	<1	<1	<5	<1	<0.5
	Maximum	6.3	30	70	12	32	70	1
	Data Count	52	56	56	56	56	56	39
Total of all Zones	Minimum	0.4	<5	<1	<1	<5	<1	<0.5
	Median	2.3	<5	<1	<1	<5	<1	<.05
	Maximum	13.5	82	70	26	32	74	1
	Data Count	82	80	80	80	80	80	66

The median concentration of selenium in Zone 1 (4.6 µg/L) warrants further periodic monitoring as the U.S. Environmental Protection Agency criterion for the protection of freshwater aquatic life is 5 µg/L.

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Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

Date	Temp deg F	pH	EC umhos/cm	Se ug/L.....	No	B	Cl	S04	Ca	Mg	Na	K	Alk.	Hdns	Total mg/L.....	TDS	Cu	Cr	Ni	Pb	Zn	Hg
SJC001 New Jerusalem Tile Drain																						
Latitude 37 42' 32", Longitude 121 17' 55". In NE 1/4, NE 1/4, NW 1/4, Sec. 34, T.2S, R.6E.																						
New Jerusalem Tile Drain at San Joaquin River.																						
08/11/86	66	2500			4	2.5	360	480								230	1	7	<5	<5	1	
10/23/86	67				<5	2.4	410	500								280	6	26	<5	<5	<1	
12/22/86	64	7.8	2200		<5	2.4	290	430								270	<1	25	<5	<5	<1	
04/07/87	66	7.5	2500	6.2		3.0	290															
06/12/87	64		2350	4.9		2.8	444	560														
08/26/87	67	7.6		3.6		2.4	320	450								96						
02/19/88	61	7.0	2300	3.7		2.8	260	400														
03/30/88	63		2550	5.2		3.1	270	550									290					
04/22/88	64	7.2	2650	4.6		2.8	275	475									280					
05/25/88	66	6.5	2650	4.3		2.5	350	470														
SJC002 Tracy Boulevard Tile Drain Sump																						
Latitude 37 46' 47", Longitude 121 26' 15". In SE 1/4, NE 1/4, NE 1/4, Sec. 8, T.2S, R.5E.																						
1.1 mile north of Interstate 205, 150-200 feet west of Tracy Blvd.																						
04/22/86	60	6.9	2500		0.9	430	630	186	99	284	0.4	276	850	1800			2	<1	<5	<5	1	<.5
08/11/86	69		2800		28	1.2	440	460									260					
10/23/86	67				<5	1.6	270	700									300	<1	<1	<5	<1	
12/22/86	60	7.2	3100		16	0.8	400	320									350	<1	<1	<5	<1	
06/12/87	65		3050	3.2		1.1	615	580														
08/26/87	71	7.5		2.3		1.0	270	320														
SJC003 Grant Line Road Tile Drain Sump																						
Latitude 37 45' 29", Longitude 121 30' 9". In NW 1/4, NW 1/4, SE 1/4, Sec. 14, T.2S, R.4E.																						
0.6 east of Hansen Rd., south of Grantline Rd.																						
08/12/86	67		2800		<5	2.9	490	370									280	1	<1	<5	<1	
10/23/86	68				<5	3.0	530	340									290	<1	<1	<5	<1	
12/22/86	64	7.6	2600		<5	3.0	420	210									270	<1	<1	<5	<1	
06/12/87	65		2700	2.7		2.8	541	335														
08/26/87	69	7.4			1.5		2.6	590	400													

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

Date	Temp deg F	pH	EC umhos/cm	Se ug/L.....	Mo B	Cl	SO4 mg/L.....	Ca	Mg	Na	K	Total Alk.	Hdns	TDS	Cu	Cr	Ni	Pb	Zn	Hg
(continued)																				
SJC004 Bethany-Lammers Road Tile Drain																				
Latitude 37 46' 53", Longitude 121 28' 34". In SE 1/4, SE 1/4, Sec. 1, T.2S, R.4E. West of Lammers Rd., 100-200 feet north of Bethany Rd.																				
04/22/86	59	7.9	2200		0.6	390	400	129	68	270	3.0	280	590	1500	2	<1	5	<5	<1	
08/12/86	67		2100		30	0.7	320	280				310								
06/12/87	64		1950		1.2		0.6	298	230											
08/26/87	68	7.0			1.2		0.7	380	360											
													190							
SJC005 Patterson Pass Road Tile Drain																				
Latitude 37 46' 57", Longitude 121 31' 54". In NW 1/4, SE 1/4, Sec. 4, T.2S, R.4E. Northwest corner of intersection at Byron Hwy. and Patterson Pass Rd.																				
04/22/86	60	7.4	2200		3.5	295	215	81	44	350	1.4	388	355	1350	7	3	20	<5	31	
08/12/86	67		1400		<5	2.3	200	130				290				<1	<5	<5	<1	
10/30/86	69		2200		<5	4.7	320	200				400				<1	<5	<5	<1	
12/23/86	63	7.8	2200		<5	4.2	220	120				380				<1	<5	<5	<1	
04/07/87	62	7.5	2700		3.6		3.6	320												
06/17/87	64		2300		2.8		3.8	340	225											
08/26/87	67	7.5			5.2		4.6	500	360											
														242						
SJC006 Moitoso Tile Drain																				
Latitude 37 44'00", Longitude 121 27'17". In SE 1/4, NE 1/4, Sec. 30, T.2S, R.5E. West of Corral Hollow Rd., 0.5 mile south of Fabian Rd.																				
08/11/86	73		1600		<5	1.4	240	210							1	<1	<5	<1	<1	
10/23/86	68				<5	1.2	1050	840							<1	<1	<5	<1	<1	
12/22/86	64	7.7	1700		<5	1.2	230	170												
06/12/87	74		1550		2.1		1.7	230	208											
08/26/87	71	7.4			0.8		1.4	250	230											
																			138	

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ...ug/L.....	Mo	B	Cl	SO4	Ca	Mg	Na	K	Total Alk.	Hdns	TDS	Cu	Cr	Ni	Pb	Zn	Hgug/L.....
SJC007 Krohn Road Tile Drain																						
Latitude 37 44'22", Longitude 121 27'05". In N 1/2, NE 1/4, Sec. 30, T.2S, R.5E. 0.4 mile west of intersection of Fabian Rd. and Corral Hollow Rd.																						
08/11/86	66	2500			<5	2.3	380	320					260		1	<1	<5	<5	<1			
10/23/86	68				<5	1.4	240	210					320		<1	<1	<5	<5	<1			
12/22/86	65	7.6	1900		<5	1.4	260	200					310		<1	12	<5	<5	<1	<.5		
04/07/87	64	7.5	2150		1.5	1.6	340														<.5	
06/17/87	62		1850		1.4	1.4	287	210													<.5	
SJC008 Pimentel Tile Drain																						
Latitude 37 44'50", Longitude 121 27'00". In SW 1/4, NW 1/4, Sec. 20, T.2S, R.5E. 0.5 mile north of Fabian Rd., 500 feet east of Corral Hollow Rd.																						
08/11/86	68	2200			<5	1.8	320	270					320		1	<1	<5	<5	<1			
06/12/87	66	2150			2.4	1.7	376	268														
08/26/87	69	6.7			1.7	1.9	300	280					120								<.5	
SJC009 Lammers-Corral Hollow Road Tile Drain Sump																						
Latitude 37 47'05", Longitude 121 26'45". In SE 1/4, SE 1/4, SW 1/4, Sec 5, T.2S, R.5E. 0.4 mile south of Lammers Rd., 0.45 mile east of Corral Hollow Rd.																						
04/22/86	59	6.8	4500		0.8	880	710	280	198	474	0.9	350	15000	2800	1	<1	<5	<5	1			
08/11/86	65		4500		82	1.0	780	780					430									
10/23/86	66				24	1.0	770	560					410		61	<1	<5	<5	<1			
12/22/86	58	7.2	3900		16	1.0	350	260					400		<1	<1	<5	<5	<1	<.5		
06/12/87	63		4600		1.6	0.9	960	870													<.5	
08/26/87	67	7.5			2.3	1.1	860	910					130								<.5	

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ug/L.....	No	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	Total mg/L.....	TDS	Cu	Cr	Ni	Pb	Zn	Hg
SJC010 Westside Irrigation District Main Drain																						
Latitude 37 46'48", Longitude 121 30'55". In NW 1/4, NE 1/4, Sec. 10, T.2S, R.5E.																						
South of Bethany Rd. at Wicklund Rd.																						
04/22/86	67	8.0	2000		2.0	280	310	101	48	232	3.1	198	440	1200	5	3	8	<5	15			
08/13/86	66	2100		<5	2.6	310	330									<1	<1	6	<5	11	<.5	
10/30/86	60	2600		<5	3.3	400	430									<1	14	7	<5	17		
12/23/86	57	7.9	2800		<5	3.3	320	370														
04/07/87	74	8.2	2250	2.9		2.6	350															
06/17/87	64	2250		2.3		2.5	357	363														
08/26/87	77	7.8	2.5		2.9	401	405															
SJC011 Delta Avenue Tile Drain																						
Latitude 37 47'52", Longitude 121 23'10". In NW 1/4, NW 1/4, NE 1/4, Sec. 2, T.2S, R.5E.																						
South of Delta Ave., 0.25 mile east of Tom Paine Ave.																						
10/23/86	64			<5	0.3	340	150									<1	<1	<5	<1	<.5		
12/22/86	62	6.6	1500		<5	0.2	350	150								<1	<1	<5	<1			
04/07/87	62	6.7	1700	0.5		0.2	350															
06/12/87	65	2700		2.6		0.5	691	320														
08/26/87	65	6.8		0.4		0.3	320	160														
SJC013 Costa Brothers East Tile Drain																						
Latitude 37 46'18", Longitude 121 30'47". In NW 1/4, NW 1/4, SE 1/4, Sec. 10, T.2S., R.4E.																						
50 yards west of Byron Rd. and Hansen Rd. intersection.																						
08/12/86	68		4000		<5	6.2	690	990														
SJC014 Costa Brothers West Tile Drain																						
Latitude 37 46'18", Longitude 121 31'04". In NE 1/4, NW 1/4, SE 1/4, Sec. 10, T.2S., R.4E.																						
Approximately 0.3 mile west of Byron Rd. and Hansen Rd. intersection.																						
08/12/86	66		3900		<5	5.3	610	880								3	<1	6	<5	1		
10/30/86	63	3400		<5	3.9	520	550									<1	<1	3	<5	<1		
04/07/87	64	7.4	3500	2.3		3.6	510															
06/17/87	62		3550	3.0		4.7	535	715														
08/26/87	68	7.3		3.1		4.3	560	710														

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ...ug/L.....	Mo.....mg/L.....	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	Total TDS	Cu	Cr	Ni	Pb	Zn	Hg ...ug/L.....
SJC015 Castro Tile Drain																					
Latitude 37 44'05", Longitude 121 27'30". In SW 1/4, NE 1/4, Sec. 30, T.2S, R.5E. South of Interstate 205 and 0.35 mile west of Corral Hollow Rd.																					
10/23/86	66	7.8	2400			<5	2.4	860	76						300	<1	<1	<5	<5	<1	
12/23/86	62	7.6	2400			<5	2.4	250	230						280	<1	<1	<5	<5	<1	
04/07/87	66	7.6	2400			2.9	2.2	380													<.5
06/12/87	66	7.0	2300			3.1	2.3	445	325												
08/26/87	66	7.0				2.7	2.2	380	350						120						
SJC016 Earp Tile Drain																					
Latitude 37 45'39", Longitude 121 31'17". In SE 1/4, NW1/4, Sec. 15, T.2S, R.5E. 0.2 mile north of Grantline Rd., 0.5 mile east of Hansen Rd.																					
08/12/86	66		2800			<5	3.0	430	410						472	<1	<1	6	<5	<1	
10/23/86	65					<5	2.8	260	390						420	<1	<1	7.4	<5	10	<.5
12/22/86	62	7.4	2900			<5	3.1	320	250						410	<1	<1	<5	15	<.5	
04/07/87	64	7.2	3050			1.0	2.9	510													
06/17/87	64		2800			0.5	2.9	437	405												
08/26/87	67	7.2				1.8	2.5	400	380						140						
SJC017 Freeman Tile Drain																					
Latitude 37 45'43", Longitude 121 30'44". In SE 1/4, SE 1/4, NE 1/4, Sec 15, T.2S, R.4E. West of Hansen Rd., 0.25 mile north of Grantline Rd.																					
08/12/86	68		3440			<5	5.5	710	660						360	<1	<1	<5	<5	1	
10/23/86	66					<5	5.9	730	1100						360	<1	<1	<5	<5	<1	<.5
12/22/86	61	7.4	3600			<5	5.4	380	420						310	<1	<1	<5	<5	<1	<.5
04/07/87	64	7.2	3800			3.6	4.7	370													
06/17/87	64		3800			3.5	5.4	677	675												
08/26/87	68	7.2				3.9	5.0	700	760												

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

											(continued)										
Date	Temp	pH	EC	Se	Mo	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	Total TDS	Cu	Cr	Ni	Pb	Zn	Hg
				umhos/cm	...ug/L	.....	.....	.....	.....	mg/L	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
SJC018 Costa Tile Drain																					
Latitude 37 46'18", Longitude 121 31'15". In NW 1/4, NW 1/4, Sec. 10, T.2S, R.4E. At intersection of Byron Rd. and Hansen Rd. 0.5 mile west along collector drain.																					
08/12/86	69	3500	<5	4.1	660	500										1	2	5	<5	1	<.5
10/30/86	63	3200	<5	4.3	540	410										<1	<1	3	<5	<1	
12/23/86	58	8.0	3200	<5	4.4	520	460									<1	<1	<5	<5	<1	<.5
04/07/87	64	7.8	3250	1.0	3.8	560															
06/17/87	62	3800	5.5	4.6	760	515															
08/26/87	74	7.4	6.3	4.4	810	580															
SJC019 Moitoso and Castro Tile Drain																					
Latitude 37 43'58", Longitude 121 21'30". In SW 1/4, NE 1/4, Sec. 30, T.2S, R.5E. 3/8 mile West of Corral Hollow Rd. where drain turns in.																					
08/11/86	70	2000	<5	1.8	270	210										1	<1	<5	<5	<1	<.5
10/23/86	66		<5	1.6	1100	910										<1	<1	<5	<5	<1	<.5
12/22/86	61	7.6	1900	<5	1.7	250	200									<1	10	<5	<5	<1	
04/07/87	66	7.4	1900	0.5	1.6	260															
06/12/87	65	2150	0.7	2.0	368	268															
08/26/87	68	7.2	0.8	1.8	300	260															
SJC022 City of Tracy Tile Drain																					
In SE 1/4, NW 1/4, Sec. 20, T.2S, R.5E. 0.5 mile north of Fabian Rd. at end of dirt road.																					
08/11/86	74	2100	<5	1.3	270	220										1	<1	<5	<5	6	
10/23/86	70		<5	1.4	270	220										280	70	<1	<5	10	
12/22/86	57	7.6	730	<5	0.6	90	83									350	12	7	8	21	70
04/07/87	66	7.6	1950	1.1	1.4	300										140					
06/12/87	68		1900	1.0	1.4	395	201									130					
08/26/87	72	7.2	0.7	1.5	290	240															

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ug/L.....	No mg/L.....	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	TDS	Cu	Cr	Ni	Pb	Zn	Hg ug/L.....		
SJC024 Corral Hollow-Betany Road Tile Drain Sump																							
Latitude 37°46'48", Longitude 121°27'07". In SW 1/4, NW 1/4, NW 1/4, Sec. 8, T.2S, R.5E.																							
East side of Corral Hollow Rd., 0.75 mile south of Lamers Rd.																							
04/22/86	60	6.7	6200		1.4	1400	1200	445	282	561	2.0	370	2400	4200		1	<1	15	<5	1	<.5		
08/11/86	68	5900		16	1.6	1300	1100						410				3	<1	9	<5	3		
10/30/86	64	6100		16	1.9	1200	1000					520											
04/07/87	62	6.9	6850	1.0		2.0	1430																
06/12/87	63	5750	1.0		1.6	1422	1250																
08/26/87	68	6.9	0.8		1.5	1400	1200																
SJC026 Chrisman Road Tile Drain																							
Latitude 37°45'16", Longitude 121°23'50". In NW 1/4, NW 1/4, NW 1/4, Sec. 23, T.2S, R.5E.																							
At intersection of Grantline Rd. and Chrisman Rd.																							
08/11/86	66	2000		8	2.6	300	300						290			2	1	<5	<1	<.5			
10/23/86	68			<5	2.4	330	320						290			<1	<1	<5	<1	<1			
12/22/86	62	7.4	2100		<5	2.4	330	300					290			8	12	<5	<1	<1			
06/12/87	64	2000	1.7		2.5	401	320						120										
08/26/87	66	7.5	1.5		2.3	330	310																
SJC028 Critchett Road Drain																							
Latitude 37°42'53", Longitude 121°17'20". In SE 1/4, NE 1/4, Sec. 34, T.2S, R.6E.																							
At end of Critchett Rd., 1.25 mile from Kasson Rd.																							
08/11/86	72	3100		<5	3.8	290	1100						290			3	<1	5	<5	10	<.5		
10/23/86	59			<5	2.9	450	800						280			<1	<1	7.0	<5	18			
04/07/87	60	7.0	2000	2.1		1.7	180																
06/12/87	73	2900	1.7		3.0	305	831																
08/26/87	68	8.5	1.5		1.4	190	400																

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ...ug/L.....	Mo.....ug/L.....	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	TDS	Cu	Cr	Ni	Pb	Zn	Hg.....ug/L.....	
SJC029 Wright Road Collector Drain																						
Latitude 37 43'50", Longitude 121 18'38". In SE 1/4, NE 1/4, Sec. 2B, T.2S, R.6E. On Wright Rd., 0.75 mile northeast of Kasson Rd.																						
08/11/86	69	9400		35	15.0	1600	3000									2	<1	<5	<5	1	<.5	
10/23/86	65	1200		33	11.0	1500	2200									450	<1	<1	<5	<1	<.5	
12/22/86	62	7.4	8100		30	10.0	630	1000								430	<1	2	<5	<5	<.5	
04/07/87	61	6.9	9350	12.5		8.7	1610															
06/12/87	64		8450	13.5		10.4	1720	2333														
08/26/87	67	7.5		13.2		8.8	1200	2100								155						
SJC030 Yasui Ranch Surface Drain																						
Latitude 37 40'08", Longitude 121 15'18". In NW 1/4, SE 1/4, SW 1/4, Sec. 13, T.3S, R.6E. 0.5 mile south of Pipeline Rd., west of Kasson Rd.																						
10/23/86	58			<5	1.4	290	270									210	<1	<1	<5	12		
12/22/86	47	6.7	1700		<5	1.1	260	210								200	<1	11	<5	<1	<.5	
04/07/87	57	6.5	1750	3.2		1.3	255														<.5	
06/12/87	72		1500	1.7		1.2	322	203													<.5	
SJC031 Yasui (Fisk) Ranch Tile Drain																						
Latitude 37 39'26", Longitude 121 16'39". In SW 1/4, NW 1/4, SE 1/4, Sec. 23, T.3S, R.6E. 0.5 mile south of Pipeline Rd., off dirt road, 1.3 mile east of Kasson Rd.																						
02/19/88	60	7.2	1730	2.0		1.2	220	200								280						
04/22/88	65	7.6	1750	2.4		1.2	190	210														
05/25/88	62	7.3	1800	2.5		1.2	250	230								102						

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

Date	Temp deg F	pH	EC umhos/cm	Se ...ug/L.....	Mo.....mg/L.....	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	TDS	Cu	Cr	Ni	Pb	Zn	Hg.....ug/L.....
(continued)																					
SJCO32 Kelso Road Drain																					
Latitude 37°48'46", Longitude 121°32'55". In NW 1/4, SW 1/4, SW 1/4, Sec. 2B, T.1S, R.4E.																					
Kelso Rd. at Old River.																					
04/22/86	70	7.8	1400		<5	2.7	190	210	41	24	209	4.7	150	190	790	8.4	2.2	7.5	<5	13.0	<.5
08/12/86	74		3500		<5	9.0	370	270					290		2	<1	<5	<5	2	<.5	
10/30/86	61		4100		<5	11.0	790	540					408		<1	<1	3	<5	<1		
12/23/86	53	8.0	4100		<5	10.0	600	500					440		<1	8	<5	<5	2		
04/07/87	72	8.4	4350		3.1		11.0	790													
06/17/87	63		4400		2.5		10.4	881													
08/26/87	86	8.7			1.7		7.6	700													
SJC033 Mountain House Creek																					
Latitude 47°30'05", Longitude 121°31'39". In NW 1/4, NW 1/4, Sec. 4, T.2S, R.4E.																					
Mountain House Creek at Henderson Rd.																					
04/22/86	68	7.8	730		<5	1.0	76	87	28	16	89	9.3	100	120	440	17.0	5.5	32.0	<5	28.0	
08/13/86	70		410		<5	0.5	43	31					72		5	2	5	<5	10		
10/30/86	63		2900		<5	8.4	450	360					434		<1	<1	5	<5	50		
12/23/86	56	8.2	3100		<5	9.4	380	280					350		<1	<1	<5	<1	<.5		
04/07/87	78	8.8	3250		2.6		8.5	780													
06/17/87	68		900		2.2		0.6	318													
08/26/87	77	7.6			1.8		0.4	130													
SJC034 Westside Irrigation District Discharge Pump on Old River																					
Latitude 37°47'20", Longitude 121°30'46". In SW 1/4, NW 1/4, Sec. 2, T.2S, R.4E.																					
0.25 mile east of Wickland Rd., 200 feet south of Old River.																					
08/13/86	70		3900		17	3.5	630	1100					230		3	<1	6	<5	4		
10/30/86	61		5900		<5	6.9	900	1200					180		<1	<1	7	<5	<1	<.5	
12/23/86	56	7.1	5400		<5	9.3	300	660					310		<1	3	<5	<5	<1	<.5	
04/07/87	74	8.3	2350		3.2		9.4	660													
06/17/87	63		4200		6.4		4.0	620													
08/26/87	73	7.2			3.8		2.5	550													

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ug/L.....	No mg/L.....	B mg/L.....	Cl mg/L.....	SO4 mg/L.....	Ca mg/L.....	Mg mg/L.....	Na mg/L.....	K mg/L.....	Total alk. mg/L.....	Hdns	TDS	Cu	Cr	Ni	Pb	Zn	Hg ug/L.....
SJC035 Naglee - Burk Pump #6																					
Latitude 37 46'150", Longitude 121 30'12". In NE 1/4, NE 1/4, NW 1/4, Sec. 11, T.2S., R.4E.																					
South side of Bethany Rd, 3/4 mile east of Wickland Rd.																					
04/22/86	68	7.6	2700		17	2.2	420	650	137	87	350	9.3	220	680	1900	6.1	4.1	14.0	<5	11.0	
08/13/86	67		2300		9	2.7	310	550					200			5	1	7	<5	13	<.5
10/30/86	60		4800			40	5.8	760	1100				390			10	4	8	<5	12	
12/23/86	51	7.0	4500		<5	5.9	300	460					300			<1	14	5	<5	<1	
04/07/87	68	8.5	5050		4.4		4.8	520													<.5
06/17/87	64		2150		3.1		2.0	303	460												
08/26/87	77	7.6			2.7		1.7	320	430												
SJC036 Kelso Road-Byron Hwy Tile Drain Sump																					
Latitude 37 47'32", Longitude 121 32'43". SE 1/4, NW 1/4, Sec. 4, T.2S., R.4E.																					
South side of Byron Hwy, 0.2 mile east of Kelso Rd.																					
04/22/86	61	7.3	2100		<5	4.1	290	220	76	43	351	1.3	376	230	1200	7.4	4.7	7.0	<5	9.4	
08/12/86	66		1500		<5	3.3	220	130					290			6	8	10	5	26	<.5
10/30/86	69		2100		<5	5.1	300	160					420			<1	<1	<5	<5	<1	
12/23/86	60	7.6	2100		<5	4.8	190	110					390			<1	<1	<5	<5	<1	
04/07/87	64	7.3	2050		1.4		4.4	250													
06/17/87	64		2150		1.7		4.5	303	185												
08/26/87	67	7.5			3.0		4.8	390	270												
SJC037 Spirow Nicholaw Tile Drain																					
Latitude 37 44'48", Longitude 121 20'15". In NE 1/4, NW 1/4, SW 1/4, Sec. 19, T.2S., R.4E.																					
100 yards south of Byron Hwy, 1/4 mile east of Lammers Ferry Rd.																					
08/11/86	66		3100		<5	3.4	500	560					240			1	<1	<5	<5	1	
10/23/86	66				<5	3.7	540	580					270			<1	<1	<5	<5	<1	
12/22/86	62	7.4	3100		<5	3.9	310	390					280			<1	2	<5	<5	<1	
04/07/87	65	7.4	3200		4.4		3.6	520													
06/12/87	64		3000		3.7		3.5	487	540												
08/26/87	66	7.0			3.9		3.4	500	540												86

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp deg F	pH	EC umhos/cm	Se ...ug/L.....	Mo ...ug/L.....	B	Cl	S04	Ca	Mg	Na	K	Alk.	Hdhs	TDS	Cu	Cr	Ni	Pb	Zn	Hg
SJC038 JM Lawrence Jr. East Tile Drain																					
Latitude 37 45'40", Longitude 121 30'44". In NW 1/4, SE 1/4, NE 1/4, Sec. 15, T.2S., R.4E.																					
West side of Hansen Rd. 1/4 mile north of Grant Line Rd.																					
08/12/86	67		3400			<5		3.2	650	450						1	<1	8	<5	1	
10/23/86	66					<5		3.1	780	480						410	<1	<1	<5	<1	
12/22/86	61	7.6	3600			<5		3.1	520	320						410	<1	<1	<5	<1	
04/07/87	64	7.4	3700			1.4		2.8	370												
06/17/87	65		3500			1.7		3.1	703	470											
08/26/87	69	7.5				1.5		2.9	610	490											
SJC039 JM Lawrence Jr. West Tile Drain																					
Latitude 37 45'32", Longitude 121 31'17". In SW 1/4, SW 1/4, NE 1/4, Sec. 15, T.2S., R.4E.																					
50 yards north of Grant Line Rd, 0.5 mile west of Hansen Rd.																					
08/12/86	67		2300			7		2.3	410	230						370	1	<1	<5	<1	
10/23/86	65					<5		2.3	520	250						350	<1	<1	<5	<1	
12/22/86	62	7.5	2500			<5		2.4	270	190						380	<1	<1	<5	<1	
04/07/87	64	7.2	2600			1.9		2.2	400												
06/17/87	64		2300			2.2		2.3	376	210											
08/26/87	68	7.3				2.0		2.1	390	280											
SJC040 Sequoia Tile Drain																					
Latitude 37 45'37", Longitude 121 31'17". In SW 1/4, NW 1/4, Sec. 15, T.2S., R.4E.																					
North side of Grant Line Rd, half way between Hansen Rd and Patterson Rd.																					
08/12/86	73		3500			<5		3.8	660	520						460	2	<1	12	<5	<1
10/23/86	69					<5		3.5	680	450						460	<1	<1	9.0	<5	<1
12/22/86	62	7.5	3700			<5		3.6	420	280						430	<1	<1	7	<5	<1
06/17/87	65		3500			0.9		3.2	620	475											

Table 3. Water Quality Data for sites monitored in Western San Joaquin County.

(continued)

Date	Temp	pH	EC	Se	Mo	B	Cl	SO4	Ca	Mg	Na	K	Alk.	Hdns	Total TDS	Cu	Cr	Ni	Pb	Zn	Hg
		deg F	umhos/cm	...ug/L	....	.....	.....	.....	.....	.....	.....	mg/L	.....	.....	.....	.....	.....	.....	.....	.....	.....
SJC041 Reeve Road Tile Drain																					
Latitude 37 45' 49", Longitude 121 30'00". In NE 1/4, NW 1/4, Sec.14, T.2S., R.4E.																					
South side of Byron Hwy, west of Reeve Rd.																					
08/12/86	67	3600	<5	6.3	610	1000									290	3	<1	11	<5	1	<.5
10/30/86	65	3900	<5	6.3	550	930									280	<1	<1	7	<5	<1	<.5
06/17/87	63	3900	5.2	6.2	582	970															<.5
08/26/87	68	7.2	5.4	5.7	650	990									85						<.5
SJC042 San Joaquin River Club																					
Latitude 37 41'15", Longitude 121 16'32". In NE 1/4, NW 1/4, SE 1/4, Sec. 11, T.3S., R.6E.																					
Near north end of pond on river side of levee.																					
08/11/86	72	1100	7	0.9	180	170									96	1	<1	<5	<5	1	<.5
06/12/87	77	1500	2.2	1.1	335	206										152					<.5
08/26/87	73	7.4	1.4	1.4	281	240															<.5
SJC043 Discharge to Sugar Cut																					
Latitude 37 46'15", Longitude 121 25'05". In SE 1/4, SE 1/4, Sec. 9, T.2S., R.5E.																					
West bank 150 yards north of Arbor Rd., 0.3 mile west of MacArthur Dr.																					
08/11/86	75	1500	<5	1.6	200	200									190	4	1	5	<5	31	<.5
10/23/86	70		<5	1.6	240	230									210	<1	<1	<5	<5	74	<.5
12/22/86	64	7.2	1800	<5	1.8	260									260	<1	14	<5	<5	12	<.5
04/07/87	67	7.7	1800	2.5	1.8	260															<.5
06/12/87	73		1600	1.1	1.5	305									208						<.5
08/26/87	71	7.0		1.4	230	230									170						<.5
SJC044 Larch Road Drain																					
Latitude 37 45'55", Longitude 121 25'05". In NW 1/4, SE 1/4, NE 1/4, Sec. 16, T.2S., R.5E.																					
South of Arbor Rd., west of MacArthur Dr.																					
08/11/86	70	2700	20	4.5	360	400									380	3	<1	<5	<5	24	<.5
12/22/86	63	8.0	3000	<5	5.1	360									440	<1	12	<5	<5	15	<.5
04/07/87	65	8.0	2950	3.5	4.9	380															<.5
06/12/87	68		2450	2.4	4.3	292									384						1

APPENDIX A

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Appendix A-1.

**Summary of constituent ranges for U.S. Bureau of Reclamation Water Quality Data.
(U.S. Bureau of Reclamation, 1987; U.S. Bureau of Reclamation, 1989)**

	EC umhos/cm	HCO ₃ mg/L	N mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	B mg/L
SJC001 New Jerusalem Tile Drain										
Minimum	2100	280	1.0	40	42	280	1.0	270	221	0.78
Median	2770	354	9.8	159	69	330	2.1	420	540	2.8
Maximum	3720	466	9.8	193	83	389	3.0	3600	630	4.2
Data Count	42	6	22	10	10	10	10	16	11	33
SJC002 Tracy Boulevard Tile Drain Sump										
Minimum	2660	230	1.0	170	84	1	0.4	440	500	0.75
Median	3488	390	4.1	210	123	348	1.0	610	600	1.3
Maximum	3920	434	1.8	277	361	420	700	3600	720	3.5
Data Count	38	5	21	9	9	9	9	14	10	32
SJC003 Grant Line Road Tile Drain Sump										
Minimum	2690	208	8.2	6.4	60	281	1	525	320	0.64
Median	3000	346	1.2	85	62	421	1	560	331	3.0
Maximum	3580	364	44.5	156	68	455	2	625	348	3.9
Data Count	12	5	11	5	5	5	5	5	5	10

	Ag ug/L	As ug/L	Cd ug/L	Cr ug/L	Cu ug/L	Fe ug/L	Hg ug/L	Mn ug/L	Mo ug/L	Ni ug/L	Pb ug/L	Se ug/L	Zn ug/L	
SJC001 New Jerusalem Tile Drain														
Minimum	<1	<1	2.2	<1	3.0	<0.1	<10	<1	<1	<1	<1	<1	<10	<10
Median	<1	<1	3.6	3	160	0.1	<10	2	9	<1	5	5	<10	<10
Maximum	<1	2	4.6	5	670	0.3	30	7	33	7	8	8	20	20
Data Count	2.0	1.8	2.0	2.2	2.4	2.1	2.2	2.1	2.4	2.4	1.9	2.5	2.5	2.3
SJC002 Tracy Boulevard Tile Drain Sump														
Minimum	<1	2	<1	<1	<10	<0.1	50	4	<1	<1	<1	<1	<10	<10
Median	<1	3	<1	3	2	30	<0.1	95	12	8	2	3	<10	<10
Maximum	1	4	1	9	6	210	0.1	460	24	31	7	5	40	40
Data Count	17	18	19	21	23	20	19	20	23	23	18	24	24	20

Appendix A-2. U.S. Bureau of Reclamation Water Quality Data for Selected Monitoring Sites.

(U.S. Bureau of Reclamation, 1987; U.S. Bureau of Reclamation, 1989)

Date	Time	EC umhos/cm	HCO3 mg/L	CO3 mg/L	N mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO4 mg/L	B mg/L	Ag mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Hg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Zn mg/L	
SUC001 New Jerusalem Tile Drain																									
08/19/82	1330	2440	466	0	12.5	40	42	360	2	440	221	3.5													
09/23/82	1100	2670	348	0	9.8	176	78	290	3	440	564	3													
11/22/82	1150	24.00	326	0	9.6	157	62	306	3	340	540														
12/14/82	0940	2730			9.8																				
01/21/83	0850	2990	280		19.5	144	68	385	3	420	605	0.78													
02/22/83	1315	2910			5.3																				
03/28/83	1115	3720			10																				
04/18/83	1130	2980	360		10.4	128	71	380	3	500	513	2.8													
05/16/83	1100	2960			1																				
06/13/83	1025	3180			7.5																				
07/18/83	1050	3060			9.8																				
08/15/83	1050	3190	372		24.2	193	83	389	1	450	542	4.2													
09/12/83	1120	2680			9.6																				
10/17/83	1100	2600			9.4																				
01/23/84		2420			8.8																				
03/12/84		2620																							
04/02/84		2500																							
04/23/84		2840																							
05/21/84		2920			14.3																				
06/18/84		3050			10																				
07/23/84		3010			11																				
08/20/84		2820			10																				
09/24/84		2670																							
10/09/84		2960			98																				
11/12/84		2300			8.6																				
12/10/84		2300																							
02/14/85		2240																							
03/14/85		2250																							
04/11/85		2650																							
05/09/85		2830																							
06/06/85		2880																							
07/12/85		2820																							

Appendix A-2. U.S. Bureau of Reclamation Water Quality Data for Selected Monitoring Sites.

(U.S. Bureau of Reclamation, 1987; U.S. Bureau of Reclamation, 1989)

Date	Time	EC umhos/cm	HCO ₃	CO ₃	N	Ca	Mg	Na	K	Cl	SO ₄	B	Ag	As	Cd	Cr	Cu	Fe	Hg	Mn	Mo	Ni	Pb	Se	Zn	
SJ001 New Jerusalem Tile Drain (continued)																										
08/09/85		2810				180	78	330	1.9	400	500	2.8	<1	2	<1	29	1	<30	0.1	<10	1	7	<1	2	<10	
09/13/85		2840								400	630	3.0	<1	1	<1	46	3	80	0.2	<10	4	3	<1	5	<10	
10/11/85		2240									2.6					37	2	0.2			1	6			4	
11/08/85		2230										2.4				40	2		<0.1		1	1			4	
12/06/85		2100				9.5	120	51	280	1.4	270	420	<1		<1	34	<1	36	0.2	14	2	9	<1	4	<10	
01/10/86		2250										<1			<1	43	<1	<60	<0.1	<10	1	<1		3	<10	
05/09/86		2940								180	69	330	1.9	370	550	2.5								5	<10	
08/08/86		2850									160	68	310	2.2	380	500	3.0								4	<10

SJ002 Tracy Boulevard Tile Drain Sump

09/23/82	1220	3350	390	0	3.6	277	127	361	1	700	678	1.3															
11/22/82	1115	3480	380	0	1.4	251	361	1	700	696	696	1.3															
12/14/82	0840	3690			5.8																						
01/21/83	0805	3510	230			1	227	130	348	5	710	610	0.78														
02/22/83	1150	3800			10																						
03/28/83	1005	3720			18																						
04/18/83	1005	3496	424		10.7	175	123	397	1	700	590	1.2															
05/16/83	0920	3650			9																						
06/13/83	0850	3140			5.3																						
07/18/83	0950	3680			4.8																						
08/15/83	0855	3470	434		6.4	191	123	420	1	613	532	2.1															
09/12/83	1000	3430			3.6																						
10/17/83	0910	3660			3.3																						
01/23/84		3330			3.7											561											
03/12/84		3600															1.1	<1	2	<1	3	30	<0.1	120	14		
05/21/84		3560			4.1											3600	1.2	1	<2	4	20	<0.1	90	24	11		
06/18/84		3220			6											1.1	<1	2	<1	3	40	<0.1	110	15	1		
07/23/84		2810			7.4											460	1.1	<1	<1	3	<20	<0.1	53	12	12		
08/20/84		3450			4.1											600	1.4	<1	<1	8	<20	<0.1	120	4	28		
09/24/84		3620														1.8	<1	2	<1	8	<1	60	0.1	50	12	12	
10/18/84		3540			2.3											610	1.7	<1	3	2	4	<0.1	100	12	31	3	2
11/12/84		3390			1.6											1.5	<1	3	<1	3	1	<10	<0.1	110	12	5	<1

Appendix A-2. U.S. Bureau of Reclamation Water Quality Data for Selected Monitoring Sites.

(U.S. Bureau of Reclamation, 1987; U.S. Bureau of Reclamation, 1989)

Date	Time	EC	HCO ₃	CO ₃	N	Ca	Mg	Na	K	Cl	SO ₄	B	Ag	As	Cd	Cr	Cu	Fe	Hg	Mn	Mo	Ni	Pb	Se	Zn	
		umhos/cm	.....	.....	mg/L	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
SJC002 Tracy Boulevard Tile Drain Sump (continued)																										
12/10/84		3500																								
01/14/85		2870																								
02/14/85		3510																								
03/14/85		3690																								
04/11/85		3310																								
05/09/85		3920																								
06/06/85		2660																								
07/12/85		3040																								
08/09/85		2820																								
09/13/85		3090																								
10/07/85		3580																								
11/04/85		3570																								
12/06/85		3410																								
01/09/86		3690																								
05/09/86		3470																								
08/08/86		2960																								
SJC003 Grant Line Road Tile Drain Sump																										
09/23/82	1310	2710	350	0	11.8	156	62	281	2	560	348	3.2														
11/22/82	1050	2970	342	0	11.8	129	60	421	1	620	331	3														
12/14/82	0905	3010																								
01/21/83	0825	3350	208																							
02/22/83	1200	3580																								
04/18/83	1025	2690	364																							
05/16/83	0950	3270																								
06/13/83	0905	2990																								
07/18/83	0920	3030																								
08/15/83	0900	2960	346																							
09/12/83	1016	2860																								
10/17/83	0940	3010																								

